METHOD AND APPARATUS TO PREVENT A BEARING FROM ROTATING IN A BEARING HOUSING

TECHNICAL FIELD OF THE INVENTION

The invention relates to a bearing held within a bearing housing, wherein the bearing supports a moving shaft. Particularly, the invention relates to a mechanism for preventing a bearing insert from moving within a surrounding bearing housing.

BACKGROUND OF THE INVENTION

Vibratory conveyors are widely used for material handling, and typically include a generally elongated conveyor bed, and an associated vibratory drive. Operation of the vibratory drive induces vibratory motion in the conveyor bed, which motion in turn induces movement of articles along the bed. Vibratory drives for such devices typically include one or more pairs of counter-rotating shafts having eccentrically-mounted weights thereon for inducing the desired vibration of the conveyor bed.

In the design of machinery involving the use of rotating shafts, bearings are employed to support the shafts, and to allow them to rotate freely with a minimum energy loss from friction. For cost effective design, it is desirous to minimize the weight of such machinery as much as possible. This is particularly true in the design of vibratory conveying and feeding equipment where unnecessary weight is detrimental in terms of increased power requirement, size, isolation system, and cost.

One approach to weight reduction involves the use of readily available standard bearing housings into which the bearings are press fitted. This approach is advantageous compared to press fitting the bearings directly into the wall of the support structure which would require the wall to be of substantial thickness thereby adding considerable weight and cost to the structure. The bearing housing generally consists of a cast iron ring with a mounting flange that may be an integral part of the housing, or may be a separate formed sheet steel component keyed to hold the cast iron ring in place. A hole is bored into the center of the cast ring, sized to the proper diameter for a press fit of the bearing insert into the hole.

The bearing and bearing housing together are fitted to an end of the shaft, which then can be bolted to the periphery of a hole cut in the wall of the support structure used to mount the shaft as applicable to the particular machine design. A further bearing housing and bearing can be fitted to the opposite end of the shaft, and the further bearing housing can also be bolted to the support structure as applicable to the particular machine design.

SUMMARY OF THE INVENTION

The present invention provides a low cost apparatus and method for preventing a bearing, fit in a bearing housing, from rotating within the housing when subjected to loads, such as eccentric loads that would be encountered in vibratory feeder and conveyor applications. The bearings can be, for example, a press fit or slide fit bearing fit into a standard light weight bearing housing.

In applications where the rotating shaft imposes an eccentric load on the bearing, as would be the case for vibratory conveying and feeding equipment, the present inventor has recognized a potential problem whereby the orbiting peak force may be large enough to overcome the press fit hoop forces holding the bearing in place, causing the bearing to rotate in the bearing housing and resulting in premature failure of the bearing.

The recognition of this failure mechanism involved FEM analysis and testing. The source of the problem was elusive heretofore because of the apparent substantiality of the cast iron ring of the bearing housing and the randomness of the failures encountered, in that some bearings failed quickly, others failed at various longer time intervals, and some did not fail at all during the period in which the problem existed. As it turns out, the bearing housing can only exert as much holding force as that limited by the insertion of the bearing to cause the housing ring to stretch elastically, analogous to placing an elastic band around some objects to keep them together. In applications involving 1 7/16" bearings and 1 15/16" bearings for example, the measured forces holding the bearings amounted to forces only in the range of 250 to 450 lbs., far below the peak rotational forces generated by the eccentric shaft loading. The randomness of the failures is in part attributed to manufacturing tolerances in the machining of the press fit hole in the housing ring, and to differences in application due to the actual load seen by the bearing.

The bearing assembly of the invention includes a bearing, such as a sleeve bearing or a ball bearing, having a central opening for receiving a shaft and having a first radial surface. The assembly includes a bearing housing having a surrounding wall which defines an open distal end and an open base end. The housing has a second radial surface extending radially inwardly from the surrounding wall. The assembly includes a support wall or support plate arranged adjacent to the open base end of the housing. The assembly includes at least one male thread formation and at least one coacting female thread formation associated with the bearing housing and the support wall. Relative rotation between the male thread formation and the female thread formation draws the bearing housing to the support wall. A spring, such as a Belleville washer or frustoconically-shaped washer, is placed between the support wall and the bearing such that when compressed, the washer resiliently presses the first radial surface against the second radial surface.

Advantageously, the male thread formation and the female thread formation are provided by a plurality of threaded fasteners which are inserted through holes provided on the bearing housing and are threaded into threaded apertures provided by the support wall, or by nuts located behind, or associated with the support wall.

When the housing and support wall are drawn toward each other, the spring is compressed under great force. This presses the first and second radial surfaces together under great force. Thus, there is an axial force between the first and second radial surface and the washer and the trailing end of the bearing and the support plate which frictionally fixes the bearing against any relative rotary movement between the bearing and the housing.

The invention provides a novel method and assembly to hold the bearing in the bearing housing with sufficient force to prevent the bearing from rotating under the applied loads previously discussed. The invention is advantageously applied to vibratory feeders and conveyors. The invention is also useful in a variety of applications that utilize a standard or press fit between the bearing and bearing housing that may have similar applied loads or that may otherwise require additional holding force to prevent the bearing from rotating in the housing.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a perspective view of a vibratory conveyor which incorporates bearing assemblies of the present invention;